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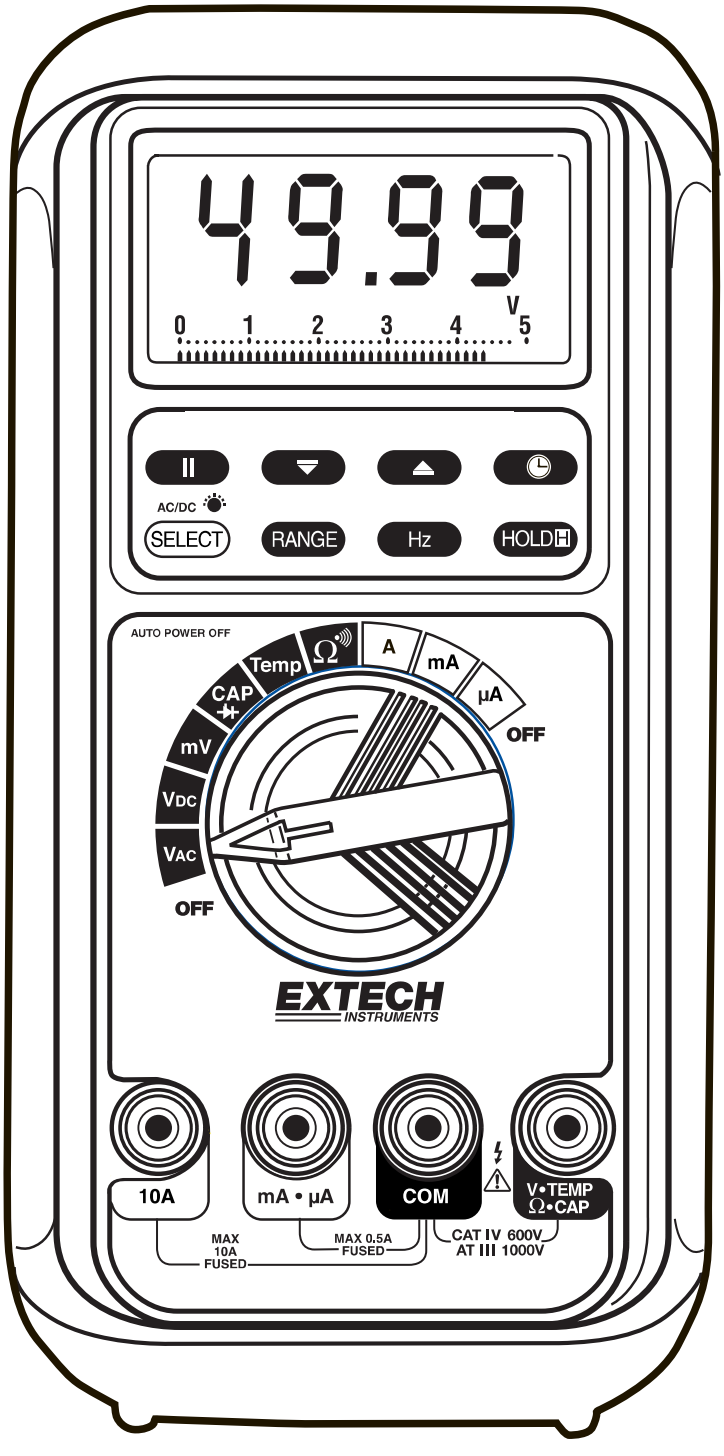
User's Guide

EXTECH INSTRUMENTS

MultiLog™ Digital MultiMeter
With built-in Datalogger

Model ML720



Introduction

Congratulations on your purchase of Extech model ML720 True rms datalogging digital multimeter. Properly used, this meter will provide many years of reliable service.

The MultiLog™ measures AC/DC Voltage/Current, Resistance, Frequency, Capacitance, Temperature, Diode, and Continuity. The MultiLog™ offers a built-in datalogger and an optical RS-232 interface. The meter stores 43,000 data points in internal memory.

Safety

International Safety Symbols

This symbol, adjacent to another symbol or terminal, indicates the user must refer to the manual for further information.

This symbol, adjacent to a terminal, indicates that, under normal use, hazardous voltages may be present

Double insulation

Safety Precautions

1. Improper use of this meter can cause damage, shock, injury or death. Read and understand this user's manual before operating the meter.
2. Make sure any covers or battery doors are properly closed and secured.
3. Always remove the test leads before replacing the battery or fuses.
4. Inspect the condition of the test leads and the meter itself for any damage before operating the meter. Repair or replace any damage before use.
5. Do not exceed the maximum rated input limits.
6. Use great care when making measurements if the voltages are greater than 25VAC rms or 35VDC. These voltages are considered a shock hazard.
7. Always discharge capacitors and remove power from the device under test before performing Capacitance, Diode, Resistance or Continuity tests.

8. Remove the battery from the meter if the meter is to be stored for long periods.
9. To avoid electric shock, do not measure AC current on any circuit whose voltage exceeds 500V AC.
10. Voltage checks on electrical outlets can be difficult and misleading because of the uncertainty of connection to the electrical contacts. Other means should be used to ensure that the terminals are not "live".
11. The product is intended only for indoor use
12. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
13. Pollution degree: 2

PER IEC1010 OVERVOLTAGE INSTALLATION CATEGORY

OVERVOLTAGE CATEGORY I

Equipment of OVERVOLTAGE CATEGORY I is equipment for connection to circuits in which measures are taken to limit the transient overvoltages to an appropriate low level. Note – Examples include protected electronic circuits.

OVERVOLTAGE CATEGORY II

Equipment of OVERVOLTAGE CATEGORY II is energy-consuming equipment to be supplied from the fixed installation.

Note – Examples include household, office, and laboratory appliances.

OVERVOLTAGE CATEGORY III

Equipment of OVERVOLTAGE CATEGORY III is equipment in fixed installations.

Note – Examples include switches in the fixed installation and some equipment for industrial use with permanent connection to the fixed installation.

OVERVOLTAGE CATEGORY IV

Equipment of OVERVOLTAGE CATEGORY IV is for use at the origin of the installation.

Note – Examples include electricity meters and primary over-current protection equipment

Specifications

DC VOLTAGE

RANGE	Accuracy
50.00 mV	0.12% + 2d
500.0 mV	0.06% + 2d
5.000V, 50.00V, 500.0V, 1000V	0.08% + 2d

NMRR: >60dB @ 50/60Hz, CMRR: >120dB @ DC, 50/60Hz, Rs=1kΩ
Input impedance: 10MΩ, 16pF nominal (44pF nominal for 50mV & 500mV ranges)

AC VOLTAGE

RANGE	Accuracy
50Hz/60Hz	
50.00mV, 500.0mV, 5.000V, 50.00V, 500.0V, 1000V	0.5% + 3d
40Hz to 500Hz	
50.00mV, 500.0mV	0.8% + 3d
5.000V, 50.00V, 500.0V	1.0% + 4d
1000V	1.2% + 4d
Up to 20kHz	
50.00mV, 500.0mV	0.5dB*
5.000V, 50.00V, 500.0V	3dB*
1000V	Unspecified

*Specified from 30% to 100% of range
CMRR: >60dB @ DC to 60Hz, Rs=1kΩ
Input Impedance: 10MΩ, 16pF nominal (44pF nominal for 50mV & 500mV ranges)

DC CURRENT

RANGE	Accuracy	Burden Voltage
500.0μA, 5000μA	0.2% + 4d	0.15mV/μA
50.00mA, 500.0mA		3.3mV/mA
5.000A, 10.00A*		0.03V/A

*10A continuous, 20A for 30 seconds max with a 5 minute cool down interval

AC CURRENT

RANGE	Accuracy	Burden Voltage
50 / 60Hz		
500.0μA, 5000μA	0.6%+3d	0.15mV/μA
50.00mA, 500.0mA	0.6%+3d	3.3mV/mA
5.000A, 10.00A*	0.6%+3d	0.03V/A
40Hz to 1kHz		
500.0μA, 5000μA	0.8%+4d	0.15mV/μA
50.00mA	0.8%+4d	3.3mV/mA
500.0mA	1.0%+4d	3.3mV/mA
5.000A, 10.00A*	0.8%+4d	0.03V/A

*10A continuous, 20A for 30-second max with 5 minute cool down interval

TEMPERATURE

RANGE	Accuracy
-50°C TO 1000°C	0.3% + 3d
-58°F TO 1832°F	0.3% + 6d

RESISTANCE

RANGE	Accuracy
50.00Ω	0.2% + 6d
500.0Ω	0.1% + 3d
5.000kΩ, 50.00kΩ, 500.0kΩ	0.1% + 2d
5.000MΩ	0.4% + 3d
50.00MΩ	1.5% + 5d

Open Circuit Voltage: < 1.3VDC (< 3VDC for 50Ω & 500Ω ranges)

CAPACITANCE

RANGE	Accuracy*
50.00nF, 500.0nF	0.8% + 3d
5.000μF	1.0% + 3d
50.00μF	2.0% + 3d
500.0μF	3.5% + 5d
9999μF	5.0% + 5d

*Accuracies with film capacitor or better

FREQUENCY

Function	Sensitivity (ACrms)	Range
mV	300mV	10Hz - 125kHz
5V	2V	10Hz - 125kHz
50V	20V	10Hz - 20kHz
500V	80V	10Hz - 1kHz
1000V	300V	10Hz - 1kHz
Ω, Cx, diode	300mV	10Hz - 125kHz
μA, mA, A	10% F.S.	10Hz - 125kHz

Accuracy: 0.01% + 2d

Accuracy Notes: Accuracy is ± (% reading digits + number of digits), or as otherwise specified, at 23°C ±5°C < 75% R.H. True RMS accuracies are specified from 5% to 100% of range or as otherwise specified. Maximum Crest Factor <3:1 at full scale & <6:1 at half scale (with frequency component within the specified frequency bandwidth for non-sinusoidal waveforms).

Audible Continuity:

Measurement threshold: Beeper will sound if measurement is below 20Ω. Beeper will not sound if measurement is above 200Ω. Beeper may or may not sound if measurement is between 20 and 200Ω. Response time: < 100μs

Digital Display: 5000-count LCD display; 5 per second nominal refresh rate

Bar Graph Display: 52-segment bargraph; 60 per second nominal refresh rate

Datalogging Capacity: 43000 points

Datalog Sample Rate: 0.05 (0.2 for °C/°F & Ω, 0.4 for HZ and 1 for C), 1, 20, 40, 60, 120, 240 & 480 seconds

Low Battery: Below approx. 7V

Operating Temperature: 32° to 113°F (0° to 45°C)

Storage Temperature: -4° to 140°F (-20 to 60°C

Relative Humidity: Max 80% up to 87ºF (31ºC) decreasing linearly to 50% at 113ºF (45ºC) <80% storage

Altitude: Operating below 2000 meters

Temp. Coefficient: Nominal 0.15 x specified accuracy per ºC (between 0 and 18°C or 28 to 50°C), or as otherwise specified

Power Supply: 9V battery (NEDA1604, JIS006P or IEC6F22)

AC Sensing: True RMS

Auto Power Off: After 17 minutes of inactivity with no input signal

Safety: Intended for indoor use and protected by double insulation per EN61010-1 and IEC61010-1 2nd Edition (2001) to CAT III 1000V & CAT IV 600V. The meter also meets UL3111-1(1994)* and CSA C22.2 No. 1010-1-92* to CAT III 1000V.

Terminals (to COM) ratings:

V : CATEGORY III 1000 VOLTS AC & DC, AND CATEGORY IV* 600 VOLTS AC & DC.

A / MAμA : CATEGORY III AND CATEGORY IV* 500 VOLTS AC AND 300 VOLTS DC.

**Category IV safety standard (for DMMs) was first released in IEC61010-1 2nd Edition in year 2001, and was yet a UL published standard at the time this manual was written.*

UL Certification: Meters that bear the UL marking have been investigated by UL headquarter in the USA per UL standard UL3111-1 1st Ed to its highest CAT III rating and international standard IEC61010-1 Second Edition (year 2001) to CAT IV rating. The UL markings on the meter, where applicable, are marked as “UL Listed Cat III only” and “UL Classified to IEC61010-1 2nd Ed. Cat IV”.

E.M.C.: Meets EN61326(1997, 1998/A1), EN61000-4-2(1995) and EN61000-4-3(1996). Also meets former standards EN55011 (1991) and EN50082-1(1997)

In an RF field of 3V/m: Capacitance function is not specified

Other function ranges: Total Accuracy = Specified Accuracy + 30 digits. Performance > 3V/m is not specified

Overload Protection:

μA/mA Range: 0.63/500V, IR 200kA, F fuse

A Range: 12.5A/500V IR 20kA, F fuse

V Range: 1050V rms, 1450V peak

mV, Ω and other: 600VDC/VAC rms

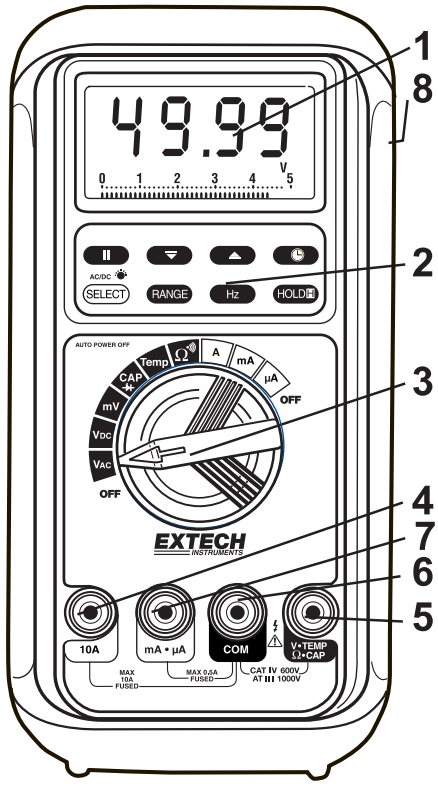
Power Consumption: 2.7mA typical

Dimension: 7.32 x 3.43 x 1.4" with holster (186mm x 87mm x 35.5mm)

Weight: 15.17 oz. with holster (430g)

Meter Description

1. 5000 count Liquid Crystal display
2. Function push-buttons
3. Rotary function switch
4. 10A input jack
5. V/Hz/Ω/Cap/Temp input jack
6. COM input jack
7. mA/uA current input jack
8. RS232 connector (rear)



Features

Analog Bargraph display

Visual indication of measurement in the tradition of an analog meter pointer. The bargraph consists of 52 discrete viewing segments. The bargraph is useful for detecting faulty contacts, identifying potentiometer gradations, and viewing signal spikes.

True RMS vs. Average Sensing (AC Measurements)

True RMS meters can accurately measure non-sinusoidal waveforms, as well as distorted sine waves that contain harmonics. Average Sensing is a fast, accurate and cost effective method of measuring pure sine wave signals. However, non-sinusoidal waveforms cannot accurately be measured using Average-sensing techniques.

Backlit display

The MultiLog™ is equipped with a backlight for viewing the LCD display in poorly lit areas.

Data Hold

The **HOLD** function freezes the reading on the display for later viewing.

Manual and Automatic Ranging

The MultiLog™ series multimeters are Autoranging, with manual override.

Smart Power Auto Power Off

Smart Power shuts the meter down automatically after approximately 17 minutes of inactivity.

Audible Beeper

To disable the audible meter tones, press and hold the Hz key while powering the meter.

Automatic Test Lead Resistance Compensation

Automatically compensates for the resistance of the test leads, as well as the internal protection circuitry automatically, ensuring greater accuracy of low resistance measurements.

Datalogging

The MultiLog™ series of multimeters store reading for review on the LCD display or downloading to a pc using the supplied software.

Operation

Measurement Considerations

NOTICE: Read and understand all **warning** and **caution** statements listed in the safety section of this operation manual prior to using this meter.

1. Always move the rotary function switch to the OFF position when the meter is not in use. This meter has Auto Power OFF that automatically shuts the meter OFF if 17 minutes elapse without activity.
2. If "OL" appears on the display during a measurement, the measurement exceeds the range selected. Change to a higher range.

AC/DC Voltage Measurements

1. Insert the black test lead into the negative **COM** jack and the red test lead into the positive **V** jack.
2. Set the function switch to the "**VAC**" "**VDC**" "**mV**" position. Press the SELECT key momentarily to toggle between AC and DC.
3. Read the voltage measurement on the display

AC/DC Current Measurements

CAUTION: Do not make current measurements at 20A for longer than 30 seconds. Exceeding 30 seconds may cause damage to the meter and/or the test leads.

1. Insert the black test lead into the negative **COM** jack.
2. For current measurements up to 4000μA, set the function switch to the "**μA**" position and insert the red test lead into the **mA-μA** jack.
3. For current measurements up to 400mA, set the function switch to the "**mA**" position and insert the red test lead into the **mA-μA** jack.
4. For current measurements up to 10A, set the function switch to the "**A**" position and insert the red test lead into the **A** jack.
5. Press the SELECT key momentarily to toggle between AC and DC.
6. Remove power from the circuit under test and open the circuit at the point where you wish to measure current.
7. Touch the black test probe tip to the negative side of the circuit and touch the red test probe tip to the positive side of the circuit.
8. Apply power to the circuit.
9. Read the current on the display

Resistance and Continuity Measurements

1. Insert the black test lead banana plug into the negative COM jack and the red test lead banana plug into the V/Ω/CAP jack.
2. Set the function switch to the "Ω •))" position.
3. Press the SELECT key momentarily to select Continuity (if required).
4. Touch the test probe tips across the circuit or part under test. It is best to disconnect one side of the part under test so the rest of the circuit will not interfere with the resistance reading.
5. For Resistance tests, read the resistance on the display.
6. For Continuity tests, If the resistance is < 20Ω, an audible tone will sound

Automatic test lead resistance calibration

When manually entering the 50Ω range (using the RANGE key) the automatic test lead resistance feature will prompt ("**Shrt**" in the display) the user to short the inputs for calibration. Short the test leads for about 3 seconds until the display shows zero. The resistance of the test leads is now subtracted from the reading. The compensation value can be as much as 5Ω.

Note: The compensation procedure must be repeated each time the range or function is changed.

Capacitance Measurements

1. Insert the black lead into the negative **COM** jack and the red test lead into the positive **CAP** jack.
2. Set the function switch to the "⊣▶⊢ **CAP**" position.
3. Press the SELECT key momentarily to select the Capacitance function (if required).
4. Touch the test leads to the capacitor to be tested and read the measured value.

Frequency Measurements

1. Connect and make the measurement required as described in the previous paragraphs.
2. Press the Hz key to select the Frequency (Hz) function.
3. Read the frequency on the display

Notes on sensitivity:

Input sensitivity varies automatically with function range selected. The mV function has the highest (300mV) and the 1000V range has the lowest (300V) sensitivity. It is recommended that the user first measure the signal voltage (or current) level before activating the Hz function to automatically set the most appropriate trigger level. You can also press the RANGE button momentarily to select another trigger level manually. If the Hz reading becomes unstable, select a lower sensitivity to avoid electrical noise. If the display is zero, select a higher sensitivity.

Diode Test

1. Insert the black lead into the negative **COM** jack and the red test lead into the positive jack
2. Set the function switch to "**CAP**" position.
3. Press the SELECT key momentarily to select the diode function (if required).
4. Touch the test probe tips to the diode or semiconductor junction you wish to test. Note the meter reading.
5. Reverse the test lead polarity by reversing the red and black leads. Note this reading.
6. The diode or junction can be evaluated as follows:
   A. If one reading displays a value and the other reading displays "OL", the diode is good.
   B. If both readings display "OL", the device is open.
   C. If both readings are very small or 0, the device is shorted.

Temperature Measurements

1. Insert the Temperature Probe into the **COM** and **TEMP** input jacks observing polarity.
2. Set the function switch to the **"TEMP"** position.
3. Use the SELECT key to toggle between ^{o}C and ^{o}F.
4. Touch the Temperature Probe tip to the device under test.
5. Wait 30 seconds for the measurement to stabilize then read the display.

Smart Power Auto Power Off

Smart Power shuts the meter down automatically after approximately 17 minutes of inactivity. The 17-minute time period is reset any time the rotary switch is moved or as long as the signal being fed into the meter is greater than 10% of the range. This prevents auto powering off during long term tests. To wake the meter, press the SELECT key or turn the meter off and on again.

Audible Beeper

The audible beeper can be disabled by pressing the Hz key while turning the meter on.

Datalogging

Datalogging Basics

The ML720 can store up to 43,000 readings automatically. These readings can be viewed on the LCD display or transferred to a PC using the PC interface cable and Windows™ software included.

Datalogging

Note: Each time the datalogging "Strt" process is initiated, existing data will be erased. Always review or download stored data before beginning a new recording session.

1. Press the ⏲ timer key to enter the sample rate mode. The default setting is 0.05 seconds.
2. Press the up/down arrow keys to select the desired sample rate.
3. Press the ⏲ timer key to store the selected sample rate.
4. Press and hold the ❙❙ "Strt, PAUS, StoP" key for 1 second until “Strt” appears in the display to start the data logging process.
5. The bargraph display will appear with a single oscillating pointer to indicate the datalogging process is in progress.
6. Press the ❙❙ "Strt, PAUS, StoP" key to pause datalogging. A blinking "H" will appear in the display.
7. Press ❙❙ again to continue datalogging. "Cont" will appear momentarily in the display.
8. Press the SELECT key to toggle between the measured value display and the data list item number display.
9. Press and hold the ❙❙ key for 1 second until “StoP” appears in the display to stop the data logging process and store the data.

Recalling Stored Readings

To recall stored data, press the START, UP or DOWN arrow key momentarily to “CALL” the logged data. The LCD will show a flashing “C” (CALL) to indicate that the data shown is logged data. The data can also be transferred to a PC using the supplied Windows™ software and interface cable. When the datalogger is paused or when the CALL mode is activated, select from the following activities for datalog viewing:

1. Use the arrow keys to scroll through the data on the meter’s LCD display.
2. Press and hold the UP or DOWN arrow keys to quickly scan the logged data. The meter provides an audible tone when the first or last reading is reached.
3. Press the UP and DOWN arrow keys at the same time momentarily to display alternately the MINIMUM and MAXIMUM readings.
4. Press the UP or DOWN arrow key momentarily while holding the HOLD key to search all of the trends in the recorded data list. The LCD will indicate MIN or MAX for each trend in the list.

Datalog Item Numbers

Each logged reading has an item number (0 to n; where n is the maximum number of records that can be stored) When the logged data entries exceed 9999, the bargraph display indicates the most significant digit of the item numbers > 10,000. For example, 1=10,000, 2=20,000, etc.

Meter Memory Full

When the meter memory is full, the datalogging process ceases automatically and the meter will enter the Auto Power OFF mode. Note that while datalogging, the Auto Power OFF mode is disabled.

Low Battery Datalogging

If the 9V battery voltage falls critically low while the meter is datalogging, the meter automatically ceases logging to ensure the integrity of the data recorded.

Non-Volatile Data Storage

Data are stored in non-volatile memory shortly after each measurement is taken to maximize data safety. However, the end-of-data information can only be stored after a datalog event is complete. Always “StoP” the datalogger before switching off the meter.

Datalogging Sampling Rate

Press the TIMER key momentarily to display the datalogger's sampling rate (recording interval). The factory default interval is 0.05 seconds, meaning that a reading will be logged every 5 hundredths of a second. Press the UP or DOWN arrow key momentarily to select an alternate sampling interval. Choose from 0.05 up to 480 seconds. Note that the fastest sampling interval for Temperature and Resistance readings is 0.2 seconds; For Frequency it is 0.4 seconds; and for Capacitance it is 1 second. Press the TIMER key again to confirm the new setting.

The Sampling Rate cannot be changed while the meter is datalogging. When a Sampling Rate of 20 seconds or longer is selected, the meter enters a standby state between readings (to conserve battery life). While in stand-by, the bargraph will continue to operate. To wake-up meter from a stand-by state in order to view a real-time measurement, press the SELECT key momentarily.

RS232C PC computer interface capabilities

This device is equipped with an optical isolated interface port located on the rear of the meter. The data acquisition package includes an interface cable and Windows™ data acquisition software. The software provides in the format of a digital meter, a analog meter, a comparator meter, and a graphical display. Refer to the README file on the software disk for further details.

Maintenance

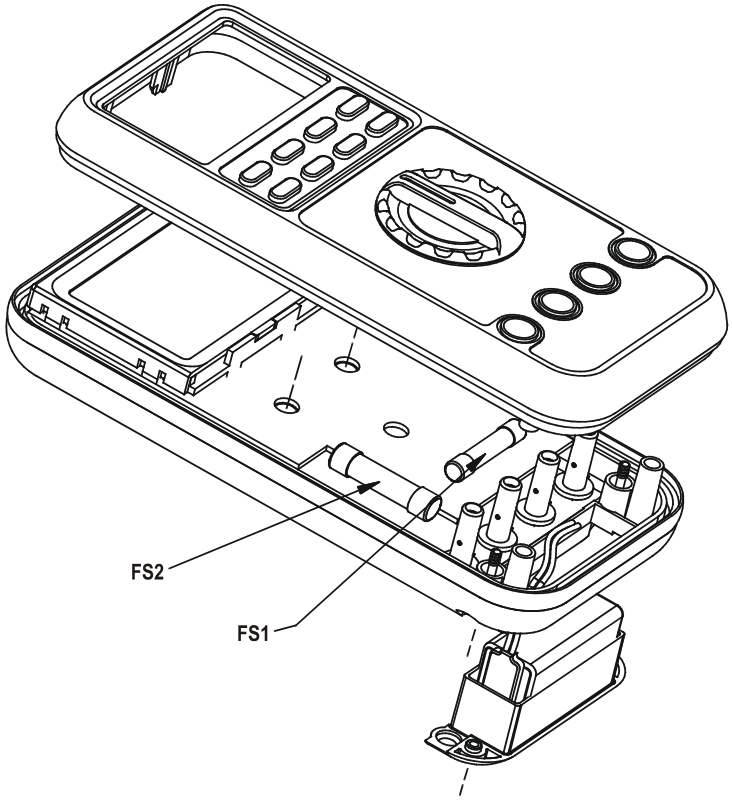
WARNING: To avoid electrical shock, disconnect the meter from any circuit, remove the test leads from the input jacks and turn OFF the meter before opening the case. Do not operate with open case. Install only the same type of fuse or equivalent

Cleaning and Storage

Periodically wipe the case with a damp cloth and mild detergent; do not use abrasives or solvents. If the meter is not to be used for periods of longer than 60 days, remove the battery and store it separately

UL Listed

The UL mark does not indicate that this product has been evaluated for the accuracy of its readings.



Battery Replacement

Loosen the 2 screws from the battery access door of the case bottom. Lift the battery access door and thus the battery compartment up. Replace the battery. Re-fasten the screws.

Battery: Standard 9V Alkaline (NEDA1604, JIS006P, IEC6F22)

Fuse Replacement

1. Remove the four screws from the case bottom and stand using a Philips head screwdriver.
2. Lift the end of the case bottom nearest the input jacks until it unsnaps from the case top
3. Replace the battery or blown fuse(s)
4. Replace the case bottom, and ensure that all the gaskets are properly seated and that the two snaps on the case top (near the display side) are engaged
5. Re-fasten the screws.

Fuses:

FS1 (µA/mA Range): 0.5/0.63 ampere F, fast acting ceramic.
Preferred: Ferraz C084205 (0.63A)
Acceptable: Bussmann ABC-1/2 (0.5A)

FS2 (A Range): 12 ampere F, fast acting ceramic.
Preferred: Ferraz D085448 (12.5A)
Acceptable: Bussmann ABC-12 (12A)

A fuse kit, Extech P/N FS880, is available that contains one each of the Ferraz fuses.

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